INSTRUCTIONS: Your Test is 75 min long. There will be 15 problems plus one bonus on the test. So if you can do 15 problems like these below in about 5 min. each, then you should be able to finish the test. (Some of the problems, such as #5, 8, 11, and 12, should only take 30 sec. to 1 min. to do, thus giving you extra time for some of the other problems). Practice doing these problems right, then time yourself make sure that you can do most of these in 5 min. or less. Each of the 15 problems will count either 7 or 8 points (I'll state which on the test) and the bonus will count 5 points.

This is what your actual test will look like…. The specific problems will, of course, be different, but the types of problems and the level of difficulty will be as below.

Study hard, and good luck! -- DJ

In (1) and (2) find all rational zeros of the polynomial. Use the Rational Zeros Theorem to list all possible rational zeros, then use synthetic division and the Factor Theorem to determine all rational zeros.

(1) \(2x^3 + 3x^2 - 11x - 6\)  
(2) \(x^5 - x^4 - 2x^3 + 2x^2 + x - 1\)

(3) Divide, using long division.\[
\frac{2x^5 - 7x^4 - 13}{4x^3 - 6x + 8}
\]

(4) Use synthetic division and the Remainder Theorem (not your calculator!) to evaluate \(P(c)\).

\[P(x) = 2x^3 - 21x^2 + 9x - 200, \quad c = 11\]

(5) Evaluate. Write your answer in the form \(a + bi\). \(\sqrt{-2}, \sqrt{-50}\)

(6) Evaluate. Write your answer in the form \(a + bi\).\[
\frac{1}{2 - i} - \frac{1}{2 + i}
\]

(7) Solve. Write complex solutions in the form \(a + bi\). \(2x + \frac{3}{x} = 2\)

(8) Simplify \(i^{99}\)
(9) Divide \[ \frac{1-3i}{4+i} \]

(10) Factor the polynomial completely (over the field of Complex Numbers). Find all the zeros (both real and complex). State the multiplicity of each zero.

\[ x^3 - x^2 + 25x - 25 \]

(11) Describe the “end behavior” of \[ P(x) = -x^5 + 2x^4 - 3x^3 - x^2 + 12 \]

(12) Subtraction of complex numbers: \[ (-7 + 3i) - (3 - 9i) \]

(13) Find the quotient and remainder using synthetic division. Write your final answer in the form of \[ P(x) = D(x)Q(x) + R(x) \]. This is what we called “form #2” in class.

\[ \frac{x^3 - x^2 - 2x + 6}{x - 2} \]

(14) Find all the real zeros using synthetic division and the quadratic formula (or completing the square).

\[ P(x) = x^3 + 6x^2 + 13x + 10 \]

(15) Find a polynomial in standard form with integer coefficients and leading coefficient 1 that satisfies the given conditions. \( P \) has degree 3 and zeros: \( 2 \) and \( 1 + 3i \)

(16) BONUS ??????